

Chapter 2

Interoperability in Digital Libraries

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ABSTRACT

This chapter presents the principles and practices of interoperability – the ability of systems to work together – as it pertains to digital libraries. While there is no well-defined theoretical basis for interoperability, it has gradually emerged as a major aspect in the creation of digital library systems, particularly in modern digital repositories such as those adopted by the Open Access movement. The need for standardisation is a key element of interoperability, and is considered in tandem with the more technical elements. Principles of interoperability have emerged through experimentation and any future attempts to infuse interoperability into a system should build on these principles, such as simplicity and orthogonality. In practice, experiments with systems and protocols have demonstrated what works and what does not and where there is a need for additional interventions, such as the successful OAI-PMH and RSS standards. The key interoperability technologies currently in use in digital library systems are introduced and contextualised in terms of their applicability and motivations. In this discussion, the line between digital library standards and Web standards is intentionally fuzzy because of the increasingly symbiotic relationship between these communities.

1. INTRODUCTION TO INTEROPERABILITY

Interoperability refers to the ability of systems to work together either to collaboratively solve a common problem or to enable the work of one

or the other system. While it is frequently used in the context of computer systems, interoperability is indeed an everyday phenomenon that is taken for granted in other walks of life.

Consider, for example, typical office stationery such as a stapler or a hole punch. A stapler uses standard-sized staples – while there are usually a few choices, only a small number are readily

DOI: 10.4018/978-1-60960-031-0.ch002

available in any country to ensure interoperability with staplers. Hole punches are preset to make holes with spacing that corresponds to ring binders and files of a particular country. While all hole punches are uniform in one country, the standard for hole punches may be different in another country.

In an IT context, interoperability of credit cards means that a restaurant can contract with one bank to process all credit card payments made at the restaurant, irrespective of the multitude of credit cards used by its patrons. Internal electronic communication among banks ensures that the correct accounts and banks are debited and credited when a transaction occurs.

In the digital library context, the Open Access¹ movement mandates that all archives adhering to its philosophies must make the metadata for their contents accessible via the Open Archives Initiative Protocol for Metadata Harvesting (Lagoze, C., Van de Sompe, & Warner, 2002) (OAI-PMH). This has been a primary requirement since the inception of the movement. The OAI-PMH allows for the exchange and sharing of metadata and therefore the creation of services on a level playing field based on openly accessible digital objects. In particular this has given rise to meta-archives and meta-search services.

In all of the above examples, from the generic everyday technology to the specifics of digital libraries, interoperability is an enabler that prevents monopolies, thus has a profound impact on society in general and specifically the development of online archives.

2. CONCEPTS, DEFINITIONS AND PRINCIPLES

2.1. Definition

Wikipedia defines “interoperability” (Wikipedia, 2009) as the ability of different systems to exchange data using the same file formats and

protocols. This includes both those systems that interoperate for the purpose of exchanging data and those that exchange data as a consequence of communication where the exchange of data is not the primary purpose (such as X10² home automation controllers, which exchange data only to control devices).

Lessig (Lessig, 2005) goes further to state that “Perhaps the most important thing that the Internet has given us is a platform upon which experience is interoperable.” This highlights the duality of interoperability – as both a syntactic and semantic construct. In the syntactic sense, interoperability of systems can be achieved by the exchange of data – in the semantic sense, making sense of that data in a standard manner is a more complex and often difficult task.

Syntactic interoperability is achieved using standards such as Extensible Markup Language (XML) (Bray, Paoli, Sperberg-McQueen, 2008), which encode data such that its structure can be understood but not its meaning. In contrast, the Dublin Core (Dublin Core Metadata initiative, 2008) metadata format is an example of a standard that focuses on semantic interoperability – standardised meaning is specified in abstract terms, with many different possible encodings.

2.2. Why Interoperability?

There are many reasons for interoperability in digital library systems. At a conceptual level, it promotes openness or choice. If an archive is able to interoperate with multiple search services, then end users may use any of the search services as a means of discovery for a single data set. This approach to search services is taken by the Networked Digital Library of Theses and Dissertations (NDLTD)³.

Archivists typically wish to connect systems together at a service or data level so their end users may be able to search through remote collections at a single portal or access point. This single access point could be a meta-search service that is

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